

Next Steps for MPCA's *Draft Analysis of the Wild Rice Sulfate Standard Study* November 20, 2014

Introduction

Minnesota Pollution Control Agency (MPCA) staff completed the *Draft Analysis of the Wild Rice Sulfate Standard Study* (draft analysis) in the summer of 2014. The draft analysis integrates the results of a two-year study, funded by the Legislature and completed by scientists at the University of Minnesota, to gather information about the effects of sulfate and other substances on wild rice growth. The goal of the study was to enhance understanding of the effects of sulfate on wild rice and to inform MPCA's decision about whether a revision is needed of Minnesota's 10 mg/liter sulfate standard to protect "water used for production of wild rice."

MPCA contracted with Eastern Research Group, Inc. (ERG) to organize an independent scientific peer review of the agency's draft analysis, which included a two-day peer review meeting on August 13-14, 2014, in St. Paul. Normally, MPCA relies on published peer-reviewed scientific studies during the development or revision of water quality standards. In this case, MPCA is analyzing the study results prior to publication of those results in scientific journals. Therefore, MPCA undertook the peer review to receive independent scientific feedback on MPCA's draft analysis. MPCA received the final report documenting the scientific peer review process from ERG in late September 2014. This report included a summary of reviewer conclusions and recommendations as well as comments from individual peer reviewers and meeting observers.

MPCA has since reviewed the peer review report, individual peer reviewer comments, and comments received from outside parties to identify the highest priority analyses or re-analyses to complete this year. When identifying these analyses, MPCA focused on those that would be most relevant to the review of the wild rice sulfate standard and those that could be completed with data that are already available from the study. The bullets below describe the analyses MPCA is planning to conduct on data from the hydroponic experiments, mesocosm experiments and field survey. They also identify additional work that MPCA will undertake to further integrate study components and synthesize the relationship between wild rice and sulfate in surface water.

MPCA expects to be working on the tasks below through the end of the 2014 calendar year. These additional tasks, together with what we have already completed as part of the draft analysis, will form the basis for a MPCA proposal outlining: any changes needed to the sulfate standard to protect wild rice; a high-level proposal related to implementation of the current standard and any proposed changes to the standard; and a proposal to clarify the definition of "water used for production of wild rice."

Additional tasks:

- Hydroponic Experiments—Further analysis of data:
 - Re-analyze the sulfide experiments with the appropriate logistic model, using time-weighted average concentrations, and calculate EC05 and EC10 concentrations with quantitative descriptions of uncertainty.
- Mesocosm Experiment—Further analysis of data:
 - Re-analyze the response of wild rice growth and seed production as a function of measured sulfate, in contrast to nominal sulfate concentrations.
 - Analyze the response of wild rice growth and seed production as a function of measured sulfide in the porewater.

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- Investigate the feasibility of modeling the multi-generational wild rice population response to the range of porewater sulfide concentrations, using data from the mesocosm experiment.
- Analyze nitrogen and phosphorus changes in the surface water of the mesocosms as a function of sulfate loading and associated sulfide concentrations.
- Field Survey—Further analysis of data:
 - Analyze surface water variables that may be correlated with sulfate, such as magnesium, nitrate, and phosphorus for their potential role in controlling the presence and absence of wild rice.
 - Investigate whether analyzing wild rice field sites based on hydrological type (e.g., lakes, streams) is useful in the evaluation of the sulfate water quality standard.
 - Explore the utility of more complex models (e.g., Structural Equation Modeling [SEM]) for developing a quantitative relationship between sulfate in the surface water and sulfide in the porewater.
 - Re-evaluate the quantile regression model that relates surface water sulfate to porewater sulfide, incorporating additional variables beyond iron, such as organic matter in the sediment. Quantify the uncertainty in the relationship between sulfate and sulfide.
- Integration of the Study Components:
 - Integrate nutrient data from the mesocosms (nitrogen and phosphorus) with field data to determine if elevated sulfate has the potential to affect wild rice populations through nutrient enrichment.
 - Document where commonalities exist between study components, where components differ, and where weaknesses in components limit the linkage of results. Where possible, integrate results from peeper profiles and the sediment incubation experiment.
- Synthesis:
 - Based on the study components and the scientific literature, quantitatively describe the relationship between wild rice, sulfate and porewater sulfide.
 - Using the models that relate sulfate in surface water to sulfide in porewater (e.g., quantile regression and SEM), estimate the confidence of predictions that would be based on the measured or predicted sulfate concentration.